

STRATEGIC VISION FOR SPECTRUM



Department of the Navy





From its founding, the Department of the Navy has turned to the electromagnetic spectrum to solve the needs of the times.

In the days before electricity, the typical sources of light below decks were candles, oil, and kerosene lamps - all of which were highly dangerous on a wooden vessel. For its time, the deck prism was considered a progressive solution to provide additional lighting in a ship's spaces. Installed flat into the deck's surface, multiple small conical prisms drew light below the decks. Without weakening the deck planks, these devices focused the ambient light and were far brighter than the light from portholes.



Department of the navy

strategic vision for spectrum

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***"The ability of forces to communicate and operate seamlessly on the battlefield
will be critical to our success."***

**- Donald H. Rumsfeld
Secretary of Defense**

**"21st Century Transformation of U.S. Armed Forces"
National Defense University, January 2002**



EXECUTIVE SUMMARY

Assured spectrum access is vital to maintaining our national security, military superiority, and our responsiveness to events that challenge our interests at home and abroad. This Department of the Navy (DON) *Strategic Vision for Spectrum* provides proactive leadership criteria.

Sponsoring innovative technology to relieve demand for electromagnetic spectrum and identifying transitions in the conduct of warfare define a basis for resourceful strategic planning. Fostering new and mutually beneficial relationships with industry groups is also a major objective. Fresh accords, forward-looking policy initiatives, and focused research transform competition for spectrum assets into productive collaboration. **The goal is an innovative, entrepreneurial, spectrum strategy based on evolving naval warfare requirements.**

The ability of Naval Forces to support diverse operations and crises is largely dependent on their ability to communicate. Uniquely, the Navy's SEAL Teams, submarines, Battle Groups, and Marine Expedition Units deployed aboard Amphibious Ready Groups, are often first to arrive in a theater and must rely on the wireless electromagnetic spectrum to remain highly maneuverable, flexible, and tactically effective. In the last few years, the rapid adoption of commercial communication technologies has taxed spectrum resources. Domestic and international companies and even civil agencies are putting pressure on their governments to allocate more spectrum to promote their telecommunication services. Worldwide, many governments consider this reallocation of spectrum simply as a way to generate revenue. Most are not aware of the impact on joint military operations and international security. As the civilian sector moves forward with faster, more convenient, and less expensive communication platforms, U.S. Military Services are under increasing pressure to vacate more spectrum and modify operational military systems.

Our notions of warfare are undergoing radical change. Industrial Age warfare, historically based on massive forces and attrition, is rapidly giving way to the understanding that forces best able to effectively employ information technologies acquire a tactical advantage. **Our forces must achieve and maintain a level of information superiority never before envisioned.** They must have the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same.

To meet this challenge, the Navy has developed the Network Centric Warfare (NCW) concept. The NCW framework outlines the way the Navy will organize and fight in the Information Age. NCW increases combat power by integrating sensors, weapon systems, decision-makers, and warfighters. The advantage is enhanced and shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a high degree of self-synchronization.

assured spectrum access is vital to maintaining our national security, military superiority, and our responsiveness to events that challenge our interests at home and abroad

operating as afloat units, sailors and Marines must rely on wireless spectrum to remain effective

military services are under increasing pressure to vacate more spectrum and modify... systems

**Spectrum
emerges as the
lifeblood of the
battlefield**

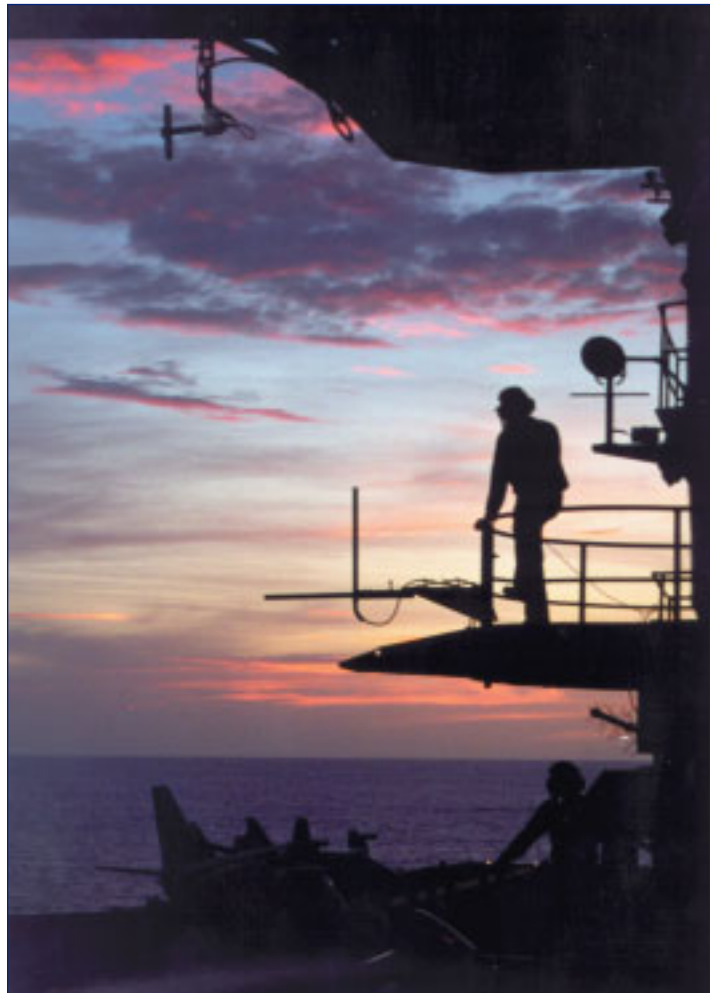
Spectrum is the key enabler of Network Centric Warfare.

"Speed of command" will decide future engagements where the precise placement and timing of forces and effects are substituted for traditional notions of combat mass. In such an information rich and highly mobile environment, spectrum emerges as the lifeblood of the battlefield.

As a Department, acting in the best interests of the American people, the DON must conscientiously apportion this limited resource between spectrum wants and actual warfighting spectrum needs. In order to accomplish this, we must demonstrate the efficient use of current spectrum assignments as well as effectively engage new technologies that will improve the use of the spectrum or reduce the amount of spectrum required.

The overriding objective – to develop a proactive, time phased spectrum strategy based on Naval warfare requirements – will allow the DON to make spectrum transparent to its warfighters. Then our forces will be able to operate any time, any place, with superior capabilities.

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INTRODUCTION

This *Strategic Vision* identifies spectrum issues crucial to Department of the Navy operational capabilities and outlines the leadership roles within the Navy and Marine Corps. The Department of the Navy Chief Information Officer (DON CIO) and the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RD&A) evaluate current and future operational and acquisition requirements and establish necessary Department policies on spectrum use and management. **The technical function where use of radio frequency spectrum is controlled to ensure the electromagnetic compatibility of communications-electronics systems is referred to as “spectrum management.”** The DON spectrum management function, by policy, is accomplished by the Chief of Naval Operations (CNO) and the Commandant of the Marine Corps (CMC) at a level thoroughly familiar with and immediately responsive to the requirements of the operating forces and sufficiently close to DON major policy making offices to facilitate referral of policy issues. The Chief of Naval Operations and the Commandant of the Marine Corps are agents for electromagnetic environmental effects and spectrum management.

the goal: an innovative, entrepreneurial, spectrum strategy based on evolving naval warfare requirements

The goal of this *Strategic Vision* is an innovative, entrepreneurial, spectrum strategy based on evolving naval warfare requirements. This will allow the Secretary of the Navy (SECNAV) to engage in overall Department of Defense (DOD) spectrum strategy planning, foster sharing

“Information dominance is key to our success, spectrum access is indispensable in achieving that dominance”

Defense Science Board

“Coping with Change,” November 2000



Navy command and control centers are afloat assets with no direct access to commercial or military communications systems via landline

and compatibility with commercial entities, recognize creative approaches to warfighting requirements, and establish professional relationships with industry groups, research laboratories, academia, and the operational DON components. Through mutually beneficial relationships with government and non-government communication interests, **policy initiatives and focused research should transform competition for spectrum assets into productive collaboration within those resources.**

The Navy has a unique challenge among the Military Services since neither its afloat command and control centers nor its mobile forward deployed Marine Corps forces have direct access to commercial or military communications systems via landline. The only access to these vital communication resources by commanders at sea is via wireless links. **A broad range of the spectrum may be required to support the functions of even a small collection of these communication networks.** Effective spectrum use becomes particularly complex as the number of spectrum dependent systems increases.

Our command, control, communications, computer, intelligence, surveillance and reconnaissance capabilities are structured to provide Naval Forces with a seamless transfer of information that allows freedom of action and limits vulnerability during both combat and non-combat operations. The capabilities of the DON's significant inventory of Radio Frequency-spectrum-dependent systems can be loosely categorized as systems that communicate information in the form of audio, video or digital data; weapon systems sensors such as radar; electronic warfare systems; and navigation systems. **This Strategic Vision expands DON policy and management scope beyond radio frequency systems.** The DON is dependent on spectrum above radio frequencies for: line of sight data transmission, weapon systems target acquisition and designation, counter-measure devices, advanced satellite imagery, and analysis of energy sources from space based platforms.

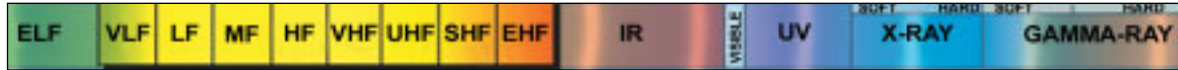
even the act of dropping a bomb has significant spectrum implications

Technologically superior and precise equipment has been critical to our combat successes. Even the act of dropping a bomb has significant spectrum implications. The Joint Direct Attack Munition (JDAM) program upgrades general purpose and penetrator bombs. Installed as a tail kit, it provides each weapon with an all-weather, autonomous, high accuracy, conventional bombing capability. **On-target delivery of a JDAM can involve 30 events of spectrum consumption.** We must strive to maintain our technical warfighting advantage as we face a wider and asymmetrical range of threats from our savvy adversaries.

The Joint Chiefs of Staff have an evolutionary model for futuristic warfare with four key operational concepts: Dominant Maneuver, Precision Engagement, Full Dimensional Protection, and Focused Logistics. The foundation that supports the mobility, flexibility, and precision necessary to accomplish these goals is the electromagnetic spectrum.

SPECTRUM

PHYSICS: What is Electromagnetic Spectrum?



The "electromagnetic spectrum" describes the entire range of light radiation, and includes:

- Radio frequency waves
- Microwaves
- Infrared
- Visible light
- Ultraviolet light
- X-rays
- Gamma rays

...the entire range of light radiation, from radio waves to gamma rays

Electromagnetic spectrum can be expressed in terms of energy, wavelength, or frequency.

Electromagnetic waves can be generated in frequency ranges from 1Hz to Gamma rays (10^{25} Hz). Radio frequency spectrum refers to the frequencies (or wavelengths) associated with radio wave propagation.



ADMINISTRATION: International

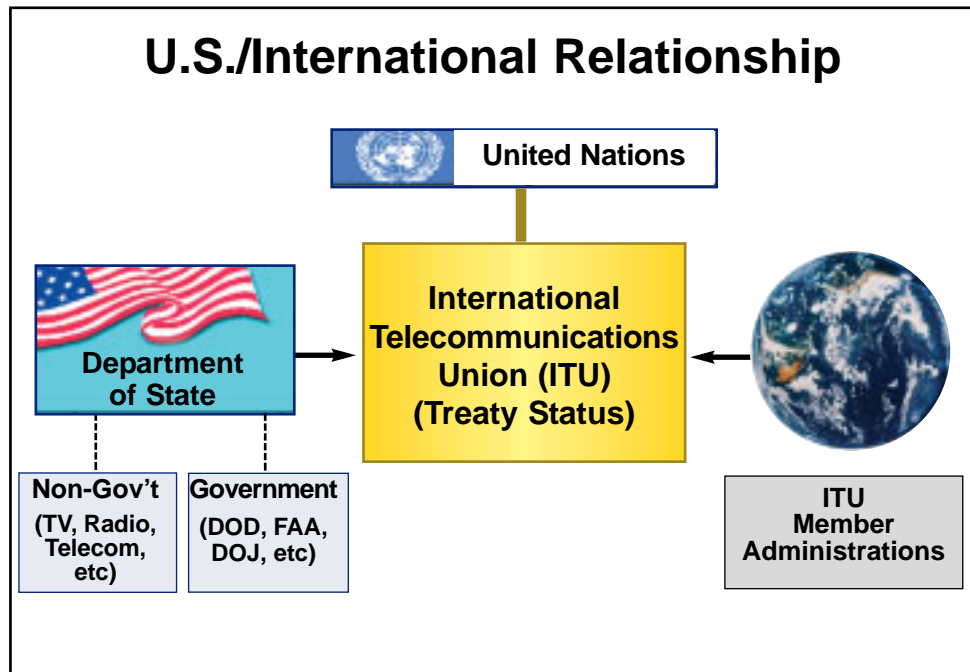
rapid globalization
of spectrum usage
impacts Navy and
Marine Corps
operations because
the DON mission is
worldwide

Because the propagation of electromagnetic waves is a physical phenomenon not limited by political or social boundaries, avoiding unintentional interference with wireless information systems in other countries is mutually beneficial. International, then national, regulatory processes control access to spectrum. **Spectrum is a national asset governed by each sovereign state.** Although standards for spectrum use vary among nations and regions of the world, economic and commercial markets--which are boundary neutral--are often the top considerations in determining spectrum policy and use.

The rapid globalization of spectrum usage impacts Navy and Marine Corps operations, because the DON mission is worldwide. The dependency of combat systems and weapons on specific spectrum affects readiness on a country-by-country basis.

The International Telecommunication Union (ITU), a specialized agency of the United Nations (UN), coordinates international spectrum standards and regulations. The international spectrum environment is growing increasingly complex. Foreign governments, in the exercise of their sovereign right, routinely make frequency allocations that do not match those in effect in the United States. Developing nations are building wireless communications capabilities both to supplement their wired communications networks and as an alternative to traditional telecom infrastructure. Developed countries have discovered the economic benefits of ubiquitous wireless communications. Consequently, the spectrum is becoming crowded worldwide.

ITU, an agency of
the UN,
coordinates
international
spectrum
standards and
regulations



The ITU has 189 member countries divided into three organizational and geographical regions for spectrum allocations. The ITU has established an international Table of Frequency Allocations that designates specific bands of frequencies for specific uses within those different regions of the globe. The United States of America participates as a member of a consortium of countries within Region 2, the Inter-American Telecommunications Commission (CITEL). CITEL hosts working groups on issues presented to the World Radio Conference (WRC) through the ITU. Each member is entitled to participate in the WRC to review and revise an international treaty—the Radio Regulations, which contain not only allocations to over 40 radio communication services but also provide the technical, operational and regulatory conditions for the use of the radio frequency spectrum and satellite orbits.

the US participates as a member of a consortium of countries within ITU Region 2

Conferences are held every two to three years and the working groups often deliberate their topics for three to six years prior to formal action. The United States has a single vote in the ITU and at the World Radio Conferences that, by treaty, govern international spectrum allocations. Unlike the United Nations Security Council, the USA does not have veto power in these communication forums. **To ensure the Navy and Marine Corps spectrum needs are made known and taken into consideration, the DON must identify concerns and monitor issues during the formation of our overall national position.** In diplomatic fashion, the U.S. Department of State then negotiates with other nations to garner their support for U.S. objectives.

specific bands of frequencies are designated for specific uses within the different regions

The global commercial telecommunication market and service capability expansion continues. The next generation of mobile wireless



critical national
security systems
operate in the
1755 - 1850 MHz
band

communications services, commonly referred to as Third Generation (3G) wireless systems, seeks spectrum in addition to that already assigned to first and second-generation mobile systems to provide terrestrial and satellite-based broadband and multi-media capabilities. Industry estimates forecast two billion wireless subscribers worldwide on 3G networks by 2010.

An example of how 3G impacts all of DOD spectrum utilization was the initiative from the May 2000 World Radio Conference, which identified 1710 - 1885 MHz and 2500 - 2690 MHz as two of the candidate bands for 3G systems to promote worldwide harmonization. In the United States, the range 1755 - 1850 MHz is an exclusive federal government band. **The DOD uses the 1755-1850 MHz frequency span to support critical systems.** Vital functions performed by those systems include the following:

- Uplink and downlink satellite operations
- Ship-to-Shore line-of-sight microwave communications principally during Amphibious operations
- Mobile microwave communications between Marine ground forces and Navy Amphibious ships
- Satellite control during launch and orbital modification
- Aviation training such as Air-to-Air, Air-to-Ground communications (voice, datalink, telemetry) and weapons performance
- Range instrumentation for training and platform evaluation

Current
Usage

Figure 1 provides an overview of UHF band competition. **Figure 2** (following pages) discusses specific current Navy and Marine Corps spectrum usage.

ADMINISTRATION: National



Within the United States, the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA), an agency of the U.S. Department of Commerce, coordinate the regulation and planning of the radio frequency spectrum.



The FCC regulates Non-Federal Government use of the radio spectrum. Radio stations belonging to, and operated by, the Federal Government come under NTIA regulatory control.

Radio frequency spectrum available for assignment to Federal Government stations is shown in the U.S. National Table of Frequency Allocations, and amplified by regulations contained in the Manual of Regulations and Procedures for Federal Radio Frequency Management. Spurred by the rapid increase in Government requirements for radio systems in the 1940s, the FCC and the President's Interdepartment Radio Advisory Committee (IRAC) agreed to a national allocation table. The domestic distribution contained some frequency bands allocated exclusively for Federal Government use, some exclusively for private sector use, and the rest shared between Government and non-Government users.

(Continued on page 10)

Current Usage: UHF Band Competition

Navy and Marine Corps Users

Commercial/Public/Other Users

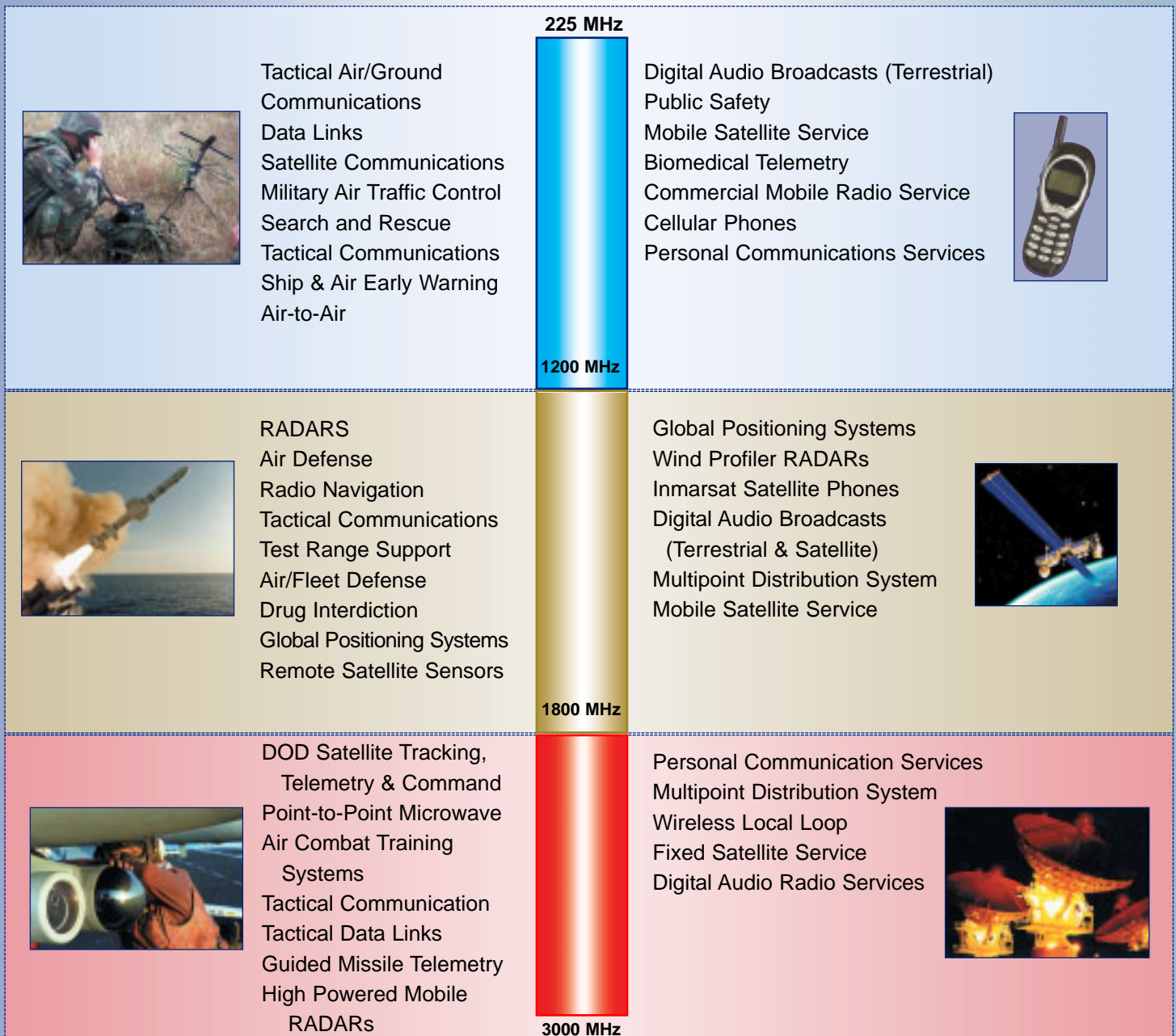


Figure 1. An Overview of Critical DON Systems and Competing Commercial/Public Systems Within the Ultra High Frequency Band (225 MHz to 3000 MHz)

CURRENT USAGE: Navy and Marine Corps

Today's Navy-Marine Corps team employs equipment and systems that capitalize on the physics of the full spectrum. **Most Navy and Marine Corps use of spectrum falls within the radio frequency range from 10s of Hz to 3 GHz.** A valuable advantage exists in this frequency range: atmospheric interaction with electromagnetic waves provides propagation characteristics that can be exploited to transfer information. This also makes the spectrum below 3GHz attractive to commercial technology and fuels efforts to evict DON and other DOD systems to transfer those frequencies to non-government use. An example of a DON operational function is included in each of the following frequency bands.

Extremely Low Frequency (ELF) is critical to both our strategic and tactical submarine forces in order to maintain a worldwide reliable link to the Commander in Chief, Vice President, Secretary of Defense, Chairman of the Joint Chiefs of Staff, and geographic Unified Combatant Commanders. One use is as a "bell-ringer" to order submerged submarines to come up to communications depth.



Very Low Frequency (VLF) is the backbone of the communication links of the Navy's submarine forces and carries the bulk of the daily message traffic and tactical direction from Fleet Commanders via shore-based facilities and Take Charge And Move Out (TACAMO) platforms.



High Frequency (HF) is used principally for Battle Group e-mail connectivity and provides reliable tactical data links for Battle Groups and other Navy and Marine Corps assets. This band is critical for allied and coalition force interoperability.



Very High Frequency (VHF) is used for amphibious and littoral operations, base communications systems, and for bridge-to-bridge, line-of-sight communications. VHF is a critical Navy aviation navigation/communication band that is extensively used by both carrier and shore-based aircraft for Air to Ground communication and Air Traffic Control. Anti-jamming in ground to ground equipment, location reporting devices, frequency hopping systems, and various tactical radio receivers also use this band.

Figure 2. Examples of DON Operational

Marine Corps Spectrum Deployment

Ultra High Frequency (UHF) is extensively used within Battle Groups and Marine Corps forces to coordinate operations. Satellite communications (SATCOM) systems, ship and airborne radars, GPS, tactical data links (Link 16), combat identification systems, command and control voice nets, and intelligence dissemination all use the UHF band. **Figure 1** (page 7) depicts critical DON systems and competing commercial/public systems/usage within the Ultra High Frequency band (225MHz to 3000MHz).

Super High Frequency (SHF) provides a high volume capability that offers reliable tactical and strategic communications to Navy and Marine Corps elements ashore and afloat. SHF is used for weapons and fire control radars, military and commercial SATCOM.

Extremely High Frequency (EHF) is used by the Milstar SATCOM system to provide worldwide, secure, jam-resistant, low probability of intercept (LPI), and nuclear-event-resistant command and control communications to strategic and tactical Naval forces through all levels of conflict.

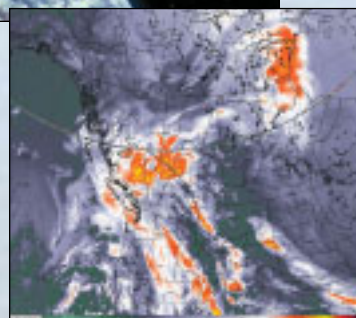
Infrared (IR) sensors (passive and active) that operate from the visible through longwave infrared bands provide signal and image processing techniques to detect, classify/identify, and localize/geolocate air, sea-surface, and ground targets as well as provide line of sight data links for installations or even portable computing devices. IR imaging devices are deployed in Unmanned Aerial Vehicles (UAVs) and space applications include satellite imagery.

Visible provides short range and directional signaling environments utilizing flashing light (Morse code), semaphore, and international flag hoists.

Ultraviolet -- This wavelength supports efforts like water purification in remote areas, bioanalysis of soils, advanced surgical procedures, and non-lethal devices to disable land mines and vehicle threats. In space based study, the Naval Research Laboratory (NRL) has recorded the first ever far-ultraviolet (UV) image of a meteor.

XRAY has applied goals such as spacecraft navigation, timekeeping, global and celestial observation and reliable computing in space.

GAMMA Ray projects advance the study of gamma rays as found in radioactive matter. The DON is supporting Large Area Space Telescope science efforts and earth based particle accelerators.



The entire Department of Defense must adhere to NTIA regulations domestically. Outside United States territory, the International Telecommunication Union (ITU), coordinates and sets international standards for use of radio spectrum.

The U.S. State Department is the Executive Branch's primary representative on foreign policy matters. Through its Economics Bureau Office of International Communications and Information Policy, the State Department represents the United States in international telecommunications forums, including bilateral and multilateral negotiations, and before international organizations.

ADMINISTRATION: Department of Defense



The Deputy Secretary of Defense affirmed the ever-increasing importance of Spectrum on our ability to effectively execute senior command level direction:

“The ability to carry out our global mission would be impossible without the use of our command, control, communications, intelligence, surveillance, and reconnaissance (C3ISR) systems, all of which are heavily dependent on the electromagnetic spectrum. To meet the Department's growing electromagnetic spectrum requirements and to address the increasing challenges to DoD spectrum access, we must ensure that DoD spectrum management is handled as efficiently as possible and that we are participating effectively in the national and international processes.”

Paul Wolfowitz

Deputy Secretary of Defense

Memorandum dtd October 18, 2001

*“Reorganization Assessment of DoD Spectrum Management
Responsibilities within the Department of Defense”*

a series of U.S.
Congressional
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400 MHz of
spectrum

During the 1990s, a series of U.S. Congressional actions and WRC decisions removed DOD access to over 400 MHz of spectrum.¹ **The bands involved were at the most desirable frequencies to support key military functions of data links, instrumentation and communications.** Relocating these functions entails both equipment redesign and compromises in performance. These actions, taken individually, might have appeared manageable, but the collective technical and cost effects are staggering. The NTIA Spectrum Reallocation Report attempted to quantify the economic impacts of reallocation. In the case of 20 Mhz forfeited in 1997, the report arrived at an extremely conservative estimate of \$1.1B affecting 10 different agencies. More recent analyses have suggested that this estimate may be too low by as much as a factor of three. In October of 2001, the NTIA announced

¹ World Radio Conference-92 (WRC) reallocated 91.5 MHz; Omnibus Budget Reconciliation Act-93 reallocated 235 MHz; WRC-95 reallocated 66 MHz, Balanced Budget Act-97 reallocated 20 MHz (2000 Defense Authorization reduced to 12 MHz).

a formal assessment to relinquish an additional 60 MHz in response to the 3G commercial requirements from the WRC-2000. These incursions into a resource that is vital to the DON's mission and success set a dangerous precedent which necessitates very close attention and proactive involvement to ensure spectrum access for Naval warfighters in the future.

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The Deputy Assistant Secretary of Defense for Spectrum, Space, Sensors & C3 (**DASD(S3C3)**) is **responsible for development of spectrum policy**. In support of this organization, the Defense Spectrum Office (DSO) provides integrated strategies, policies, processes and practices to achieve global spectrum access for national security obligations.

In the area of a national strategy, the DSO develops and executes realistic allocation/reallocation strategies. In pursuit of their mission, the DSO leverages enabling and emerging technology offered by both commercial and defense sources. **SECNAV will work actively with the DASD(S3C3) and DSO to enhance DON use of spectrum.** The DOD provides an additional interface for all military services to the NTIA on spectrum allocation.

ADMINISTRATION: **Department of the Navy**

Via the NTIA, the Government's spectrum pool was created to support federal law enforcement organizations, public safety and emergency response units, civil air traffic control, and the military services. **The entire U.S. Government has exclusive use of just 1.4% of the regulated radio frequency spectrum.** That represents a very small commitment of spectrum resources to provide for national security and critical public services.

The DON, to accomplish its warfighting mission, seeks specific allotments through DOD assignment within that 1.4%. The DON remains an accountable steward for this national asset. Based on prior spectrum distributions, the DON has responsibly committed billions of dollars in delivering systems operating in those bands historically assigned to exclusive Government use. The 'new order' of spectrum reallocation threatens this monetary and military investment.

Today, the DON faces challenges to retain adequate spectrum to perform its mission. **In recent spectrum reallocations, the DON was impacted directly in several major systems.** The first system affected was the Navy's Cooperative Engagement Capability (CEC) system, designed to link shipborne, airborne and land based radars to create a single integrated network, enhancing the capability of Naval Forces to detect and destroy threats with greater speed and accuracy. Next impacted was a shipboard radar system, the AN/SPN-43 designed for simultaneous control and identification of aircraft within an area of responsibility.

Another shipboard system constrained by spectrum reallocation was the Target Acquisition System (TAS) radar Mk 23. Deployed for identification and threat evaluation, the Mk 23 defends against high-speed, small



1.4%...a very small commitment of spectrum resources for national security and critical public services

the DON faces challenges to retain adequate spectrum to perform its mission

now threatened:
data connectivity
for ship to shore
USN/USMC
amphibious
operations

cross-section targets (such as incoming enemy missiles). **Currently threatened by proposed spectrum reallocation is the Marine Corps' extensive inventory of MRC-142 radios that operate in the 1710 to 1850 MHz band.** Used by virtually all Marine Corps components, the MRC-142 is the only reliable transmission means for robust data connectivity between mobile Division and Regimental units. Additionally, it is one of the principle providers of line-of-sight data connectivity from ship to shore for Marine Corps and Navy amphibious operations. Since the Marine Corps owns and utilizes only two types of terrestrial, digital, multichannel radios (the AN/TRC-170 and the AN/MRC-142), the importance of the MRC-142 for Command, Control, Communications and Computer (C4) operations cannot be overstated. The consequences of spectrum reallocations are not just frequency reassignments. **The long-term effect includes decreased access to essential military resources, costly system redesign, postponement of operational implementation, additional littoral frequency limitations, and elimination of key acceptance testing, which, in turn, results in systems being fielded with uncertain capabilities.**

Pursuant to the Title 10 responsibilities of the Services to equip their respective forces, the Navy maintains its own spectrum management organization and provides a representative to the Interdepartment Radio Advisory Committee (IRAC). **The DON is responsible for acquiring frequency allocation for equipment and coordinating its use** both in the United States and in foreign countries. This involves obtaining frequency certifications and assignments from the NTIA for operations in the United States, and coordinating with Host Nations through the Joint Staff Military Communications Electronics Board (MCEB) and the Unified Combatant Commanders for operations outside the United States.

Within the DON, the responsibility for effective spectrum utilization is vested at multiple organizational levels and in several policy, operational, research, and acquisition areas. (See **Figure 3.**)

SECNAV |

SECNAV'S role is to ensure DON compliance with DOD spectrum policies and to develop the DON policy and strategic planning for spectrum use. **The DON CIO is the DON point of contact for spectrum policy issues and works with industry as the Navy/Marine Corps liaison.** CNO (OPNAV) and USMC (HQMC) are the designated contacts for issues involving spectrum management and frequency assignment.

DON CIO:
Strategic Planning
& Information
Policy

The DON CIO, OPNAV, and HQMC support spectrum analysis and studies with organizations such as the Center for Naval Analyses (CNA), the Naval Postgraduate School, Office of Naval Research (ONR), Joint Spectrum Center (JSC), and the Navy Studies Board. The DON CIO collaborates with the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN (RD&A)), the Navy CIO, and the Marine Corps CIO to develop strategic planning for efficient spectrum use and development.

The Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN (RD&A)) monitors compliance with spectrum policy in all phases of the acquisition process. The ASN (RD&A) ensures that spectrum use and availability are considered in normal programmatic activities. As the DON's lead in research and development, ASN (RD&A) is actively engaged with government research agencies, industry, and private research institutes seeking to leverage new technologies to improve spectrum efficiency and decrease reliance on spectrum.

ASN (RD&A):
Research,
Development,
Acquisition Policy

The Chief of Naval Operations, Space, Information Warfare, Command and Control and the Director, Command, Control, Communications and Computers, Headquarters Marine Corps have primary responsibility for identifying requirements that support the Navy and Marine Corps operational missions. In their dual role as their respective Service's CIO, they are responsible for implementing spectrum policy guidance. They issue updates to Secretary of the Navy Instructions in support of spectrum identification and certification policies for all DON programs and DON-controlled/managed joint programs. OPNAV and HQMC issue operational guidance for control of electromagnetic interference (EMI) and the management of DON specific and shared spectrum.

CNO, CMC:
Command,
Resource
Utilization, &
Operational
Authority

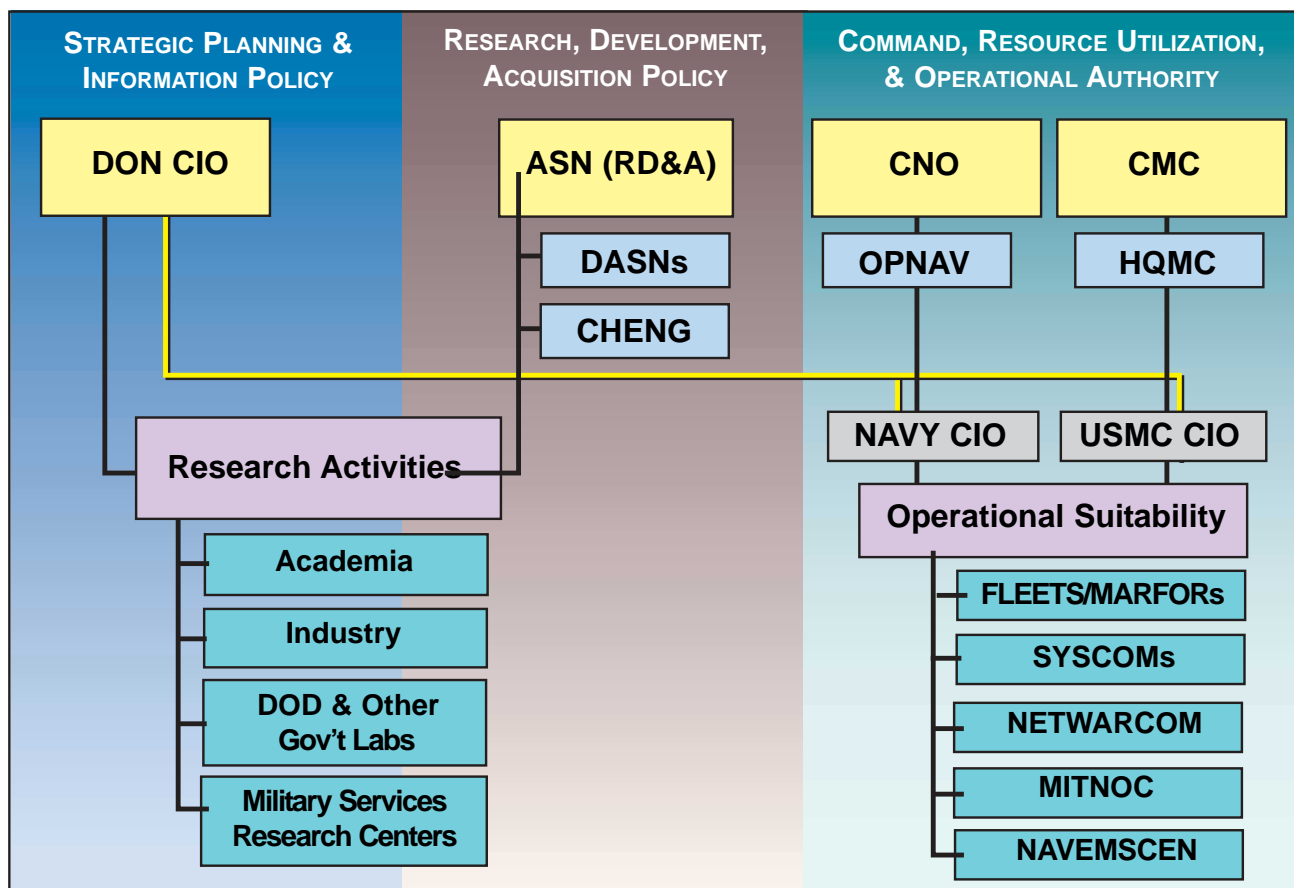


Figure 3. DON Spectrum Relationships

differing spectrum
allocations abroad
place a premium
on frequency
agility in the Navy
and Marine Corps
operational
systems

As Naval Forces deploy, the geographic Unified Combatant Commanders negotiate spectrum access with host and surrounding nations. The differing spectrum allocations abroad place a premium on frequency agility in the Navy and Marine Corps operational systems to adapt to foreign environments. **Active collaboration with other military services, the DOD, Federal Government, international spectrum groups, and foreign governments is paramount** in the DON's ability to effectively and efficiently manage the Navy and Marine Corps spectrum requirements.

The DON employs a combination of an enterprise-wide, managed system and an electronic networking architecture, known respectively as the Navy Marine Corps Intranet (NMCI) and Information Technology for the 21st Century (IT-21). The DOD Teleport further serves as an information bridge between the strategic and tactical communications networks.



Spectrum remains the key to exploit IT-21 capabilities to:

- Reach back to pull required information
- Exchange/distribute wideband information
- Process large volumes of information
- Provide reliable, jam-resistant communications, and information warfare protection



The DON contributes to the Global Information Grid (GIG) with IT-21, NMCI, and the Marine Corps Enterprise Network (MCEN). These formidable IT capabilities provide for seamless, interoperable transfer of voice, video, and data between afloat and ashore forces.



DON SPECTRUM ACTION AREAS

The DON has identified five spectrum action areas:

- Policy
- Strategic Planning
- Operations
- Acquisition
- Research & Development

Policy

SECNAV is fully committed to supporting existing DON spectrum efforts while evolving a proactive spectrum policy suited to increasing competition for spectrum allocation and innovative technical challenges.

The DON goal is to develop a realistic and dynamic Strategic Spectrum Plan that defines spectrum requirements consistent with emerging technologies, commercial trends, and increasing market demands.

Development and implementation of the plan will require participation by all Navy spectrum management organizations and activities.

The DON must continue to ensure that the Navy has the most effective representation possible in international spectrum negotiations.

The DON will provide ongoing spectrum guidance for program development. Primarily, the DON must continue to mandate all spectrum dependent systems complete certification reviews and assure compatible operation in the intended electromagnetic environment at development and acquisition stages to identify and assign required frequencies prior to expenditure of funds.

SECNAV will establish a process by which the Navy and Marine Corps can seek the most efficient use of spectrum allocations. This activity shall include identifying mature systems for transition or planned obsolescence.

To provide qualified Navy and Marine Corps spectrum managers, the DON will establish Standard Operating Procedures (SOPs) for spectrum management and support military and civilian personnel assignment qualifications.

SECNAV is fully committed to supporting existing DON spectrum efforts while evolving a proactive spectrum policy



Strategic Planning

information needs
and spectrum
requirements strain
current DON
spectrum allocations

The DON's information needs and its spectrum requirements strain current DON spectrum allocations. To support its strategy, the DON is a major user of commercial services such as satellite communications (SAT-COM), cellular telephone, and mobile services. As advanced capabilities are developed to counter emerging threats, spectrum dependent applications are projected to grow as well.

Faced with these challenges, the DON spectrum strategy will identify and proactively manage spectrum issues crucial to operational capabilities of today and requirements for tomorrow by:

an action plan for
the next 2-3
years; a vision
and strategy for
next 5-10 years;
and long-term
projections for
10-20 years out

- Developing and implementing an action plan focusing on the next 2 to 3 years
- Initiating an intermediate spectrum vision and strategy to direct activity in the next 5 to 10 year term
- Participating in long-term planning for spectrum use projecting 10 to 20 years into the future
- Tracking advanced technologies and techniques being developed in government labs, academia, and industry
- Collaborating with other services to develop a coalesced and symbiotic spectrum plan
- Providing integrated strategy for system sunset, relocation and reallocation of spectrum
- Promoting efficiency by exploiting advanced technological projects
- Envisaging warfighting requirements and hostile environments into future time intervals, and explore joint service cooperation to field common systems and share spectral allocations

These strategies must embrace and foster innovation and business partnerships with industry to encourage the development of new public and private technologies.



Operations

Sophisticated electronics systems operating in a constrained area (such as an aircraft carrier) place heavy demands on the spectrum to accommodate C4ISR information flow without mutual electromagnetic interference. Navy and Marine Corps defensive and offensive detection, tracking, and weapon systems also place heavy demands on the management and use of the electromagnetic spectrum. Operational forces must continue to be educated and trained on the technical aspects of efficient spectrum use, e.g., shared bandwidth, filter usage, and power usage.

The DON must identify technology to reduce bandwidth needed for control and instrumentation of test and evaluation. Additionally, the DON must seek spectrum consistent

with increased instrumentation and test complexity for test and evaluation and training facilities.

Improvements in modeling and simulation data to facilitate electromagnetic environmental effects (E3) analysis and deployment coordination are necessary. Additional automation to track Host Nation spectrum usage agreements is an administrative requisite.

Acquisition

The DON will ensure the appropriate use of spectrum, including electromagnetic environmental effects (E3), is considered throughout the developmental process by new and upgraded systems. Spectrum compatibility evaluations modeled early will facilitate E3 analysis. Spectrum efficiency is a priority in system development programs.

**spectrum efficiency
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development
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Spectrum conservation and efficient use will be a metric for program managers. All new and upgraded systems (including commercial off-the-shelf (COTS) equipment) will account for their spectrum use and impacts based on military capabilities and spectrum efficiency. Spectrum management requirements and E3 issues will be addressed throughout C4ISR system life cycles.

As a final check, test and evaluation will include ensuring that the system meets certification criteria. Coordination and certification rules must be enforced to avoid spectrum chaos, both in CONUS and abroad. **Spectrum requirements must be a conscious consideration from system conception through system deployment and life cycle upgrades.**



"Just as the existence of the U.S. Navy dissuades others from investing in competing navies -- ... -- we must develop new capabilities that merely by our possessing them will dissuade adversaries from trying to compete."

*Donald H. Rumsfeld
Secretary of Defense*

*"21st Century Transformation of U.S. Armed Forces"
National Defense University, January 2002*

Research and Development

The DON should maintain its pre-eminence in identifying and evaluating new techniques for efficient spectrum use that could potentially benefit the Navy and/or the Marine Corps. Spectrum sharing and software programmability are compelling technologies whose research and development has benefited from DON sponsorship.

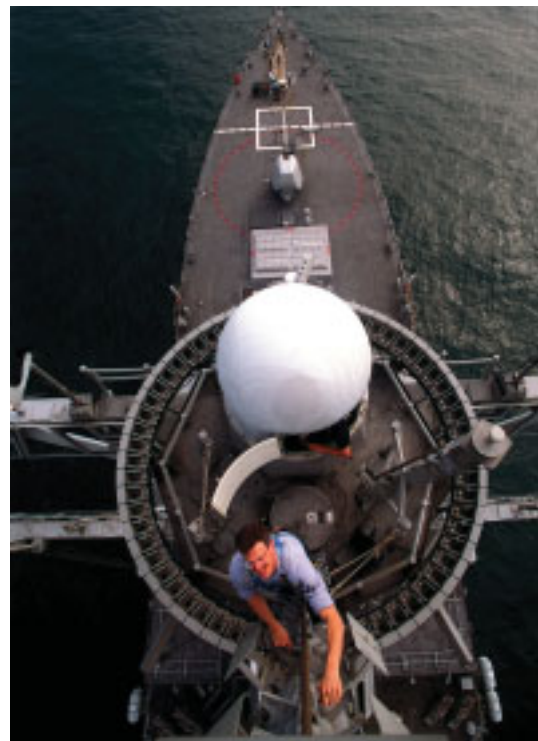
Further investment is needed to fully evaluate and exploit emerging technologies such as coherent tracking, orthogonal concepts, and adaptive bandwidth management. ASN (RD&A) will continue to theorize the practical application of promising science to the warfighting needs of the DON.

Technology advances are allowing us to use spectrum more efficiently and effectively in the areas of frequency, time, space, and modulation. We must remain open to new technologies and to adoption of doctrine or practices, which facilitate more efficient spectral usage.

We must be good stewards of all spectral resources and good proponents for why the DON must retain its current resources.



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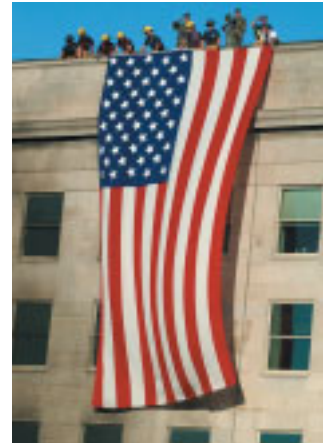


CONCLUSION

Demands for spectrum to handle the rapidly increasing information flow of modern, joint, dispersed forces are escalating rapidly. The DON recognizes that military capabilities must drive spectrum requirements. Spectrum management continues its traditional roles to provide warfighters frequency assignments and eliminate RF systems interference. To ensure uninterrupted, successful, and effective employment of U.S. Navy and Marine Corps operational capabilities, the DON will continue to challenge its approach to spectrum policy and planning.

Information dominance is key to the success of future U.S. military operations. Spectrum access is the enabler for that information dominance.

The measure of spectrum policy, planning, and management success is simple - Navy and Marine Corps warfighters must have seamless and transparent access to spectrum.



Navy and Marine Corps warfighters must have seamless, transparent access to spectrum





About the Office of the Chief Information Officer

The role of the Chief Information Officer was mandated by public law with the passage of the Clinger-Cohen Act of 1996. On May 5, 1997, the Secretary of the Navy formally established the Office of the Department of the Navy Chief Information Officer (DON CIO) in compliance with that legislation. The DON CIO reports directly to the Secretary of the Navy on all matters relating to information technology and information resource management and is organized to oversee the strategic planning, policy, development, and implementation of information technology resources for all Navy components. The DON CIO's organizational composition has evolved, yet it remains charged with responsibility for the development of strategies based on Office of the Secretary of Defense (OSD) guidance, policies, plans, architecture, standards, and for process reinvention support for the entire Department of the Navy.

The DON CIO recognizes that technology is a cornerstone for providing warfighters battlefield advantages and ultimate superiority. Through active partnerships with industry, other government agencies, academia, and our allies to identify and exploit break-through technologies we will meet our goal to develop, implement, operate, govern, and continually upgrade a global information infrastructure.

As the Department adjusts its guidance in meeting emergent and waning requirements, the CIO creates teams to focus on those major issues. In addition to Electromagnetic Spectrum Policy, DON CIO activities include the following areas: Architecture and Integration, Capital Planning, Competency Management, Computing and Communications Infrastructure, Critical Infrastructure Protection, eBusiness/eGovernment, Enterprise Knowledge, Enterprise Licensing, Information Assurance, Librarian of the Navy, Organizational eLearning, Planning and Measurement, Policy Integration, Privacy, Section 508, System Registration and Certification, Technology Enablement Strategies, Technology Innovation, and Communications and Outreach.

Our entire warfare doctrine in support of Joint Vision 2020, Network Centric Warfare, and Expeditionary Maneuver Warfare is based on access, interoperability, and security of our information and communications systems. Not only is spectrum the lifeblood of the battlefield - it is also critical to successful peacetime DON operations in a worldwide arena. The DON CIO is committed to comprehensive and innovative policy and planning initiatives that provide our warfighters vital spectrum resources any time and any place.

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**Department of the Navy
Chief Information Officer
1000 Navy Pentagon
Washington, DC 20350-1000**

www.doncio.navy.mil